CLAIMS:

1. A method of making a balance spring for use in a horological or other precision instrument, comprising the steps of winding a length of non-magnetic balance spring material formed of continuous fibres or of a ceramic, around a cylindrical former, using a releasing agent to inhibit adjacent layers of the winding from adhering to each other or to facilitate release from each other should they become adhered, and heat treating the wound balance spring material.

2. A method according to claim 1 wherein after heat treating the assembly is sliced at intervals perpendicular to the rotational axis of the former, to form a plurality of spiral springs.

3. A method according to claim 1 or 2 wherein the releasing agent is applied in vaporised particle form to the spring material.

4. A method according to claim 1 or 2 wherein the releasing agent is in the form of a solid sheet of spacing material which is wound around the cylindrical former together with the length of the spring material so that adjacent layers of the spring material are separated by the spacing material.

5. A method according to claim 4 wherein a plurality of lengths of balance spring material and a plurality of lengths of spacer material are wound around each other on the cylindrical former.

6. A method according to claim 4 or 5 further comprising the further step of removing the spacer material after heat treating.

7. A method according to any one of the above claims wherein the releasing agent is PTFE, FEP or ETFE.

8. A method according to any of the above claims wherein the balance spring material is a ceramic material.

9. A method according to any one of the above claims wherein the balance spring material is tape cast.

10. A method according to any of claims 1 to 7 wherein the balance spring material is in the form of a sheet of continuous fibre material pre-impregnated with a matrix phase.

11. A method according to any one of the above claims wherein the cylindrical former is a mandrel.

12. A method according to any of the above claims wherein the spring so formed is of flat Archimedes spiral form.

13. A method of making a balance spring for use in a horological or other precision instrument, comprising the steps of placing a length of a non-magnetic balance spring material around, in or onto a receiving plate, former or mandrel, heat treating the balance spring

material and removing it from the former, receiving plate or mandrel to form a flat Archimedes balance spring.

14. A method according to claim 13 wherein the balance spring material is wound around a conical mandrel.

15. A method according to claim 13 or 14 wherein the balance spring material is extruded.

16. A method according to any one of claims 13 to 15 wherein the mandrel, former or receiving plate is rotated such that the spring material placed onto the mandrel, former or receiving plate adopts a spiral form.

17. A method according to any one of claims 13 to 16 wherein the former, receiving plate or mandrel has channels for receiving the balance spring material.

18. A method according to any one of claims 13 to 17 wherein the former, receiving plate or mandrel is heated.

19. A method according to any one of claims 13 to 18 wherein the balance spring material is ceramic or a ceramic composite.

20. A non-magnetic balance wheel for use in a mechanical oscillator system for a horological or other precision instrument, the balance wheel including components of two different materials having different coefficients of thermal expansion arranged such that the moment of inertia of the balance wheel decreases with increasing temperature.

21. A balance wheel according to claim 20 wherein the components include a balance wheel arm having one or more cross members and a rim attached to or integral with said cross members.

22. A balance wheel according to claim 21 wherein the cross member(s) is of a first material having a first coefficient of thermal expansion and the rim is of a second material having a second coefficient of thermal expansion less than the first coefficient of thermal expansion.

23. A balance wheel according to claim 21 wherein the cross member(s) is of a first material having a first coefficient of thermal expansion and the rim comprises concave segments of a second material having a second coefficient of thermal expansion greater than said first coefficient of thermal expansion.

24. A balance wheel according to claim 21 wherein the balance wheel rim and cross member(s) are formed of a first material having a first coefficient of thermal expansion and the balance wheel further comprises two concave segments inside said rim, formed of a different material to said rim having a second coefficient of thermal expansion greater than said first coefficient of thermal expansion.

25. A balance wheel according to claim 21 wherein the balance wheel rim is formed of a first material having a first coefficient of thermal expansion and two or more

members formed of a second material having a second coefficient of thermal expansion greater than said first material are attached to said rim and extend inwardly therefrom.

26. A balance wheel for use in a horological or other precision instrument, the balance wheel comprising:

a balance wheel arm having one or more cross-members formed of a first non-magnetic material having a first coefficient of thermal expansion which is positive; and

a rim attached to said balance wheel arm, the rim being formed of a second non-magnetic material having a second coefficient of thermal expansion;

wherein said second coefficient of thermal expansion is less than said first coefficient of thermal expansion, such that an increase in temperature causes an increase in the cross member(s) length and radially inward deflection of the rim resulting in a decrease in the moment of inertia of the balance wheel.

27. A balance wheel according to claim 26 wherein there are at least two appendages to the rim in the form of non-magnetically sensitive timing weights.

28. A balance wheel according to claim 26 or 27 wherein said second coefficient of thermal expansion is negative.

29. A balance wheel according to any one of claims 26 to 28 wherein the rim comprises two or more convex arcs of equal length.

30. A balance wheel according to any one of claims 26 to 29 wherein said first coefficient of thermal expansion is less than $6\times10^{-6}K^{-1}$.

31. A balance wheel according to claim 28 or claim 29 or 30 when dependent from claim 28 wherein the magnitude of the second coefficient of thermal expansion is less than the magnitude of the first coefficient of thermal expansion.

32. A balance wheel according to any one of claims 26 to 31 wherein the appendages are arranged to give equipoise to the balance wheel.

33. A balance wheel according to any one of claims 26 to 32 wherein the first and second coefficients of thermal expansion are linear.

34. A balance wheel according to any one of claims 26 to 33 wherein there are one or more appendages arranged on the cross member(s), said appendage(s) comprising a stem and an eccentric head on the stem, the stem being rotably mounted in an aperture of the balance wheel such that it is rotatable about an axis parallel to the axis of rotation of the balance wheel, whereby the moment of inertia of the balance wheel can be fine tuned by turning of the eccentric head.

35. A balance wheel according to claim 34 wherein the adjustment member is a screw.

36. A balance wheel according to claim 34 or 35 wherein the head of the adjustment member is tapers towards the top end remote from the stem and is provided with splines for engaging an adjustment tool.

37. A balance wheel assembly comprising a balance wheel according to any one of claims 26 to 36 and a balance staff formed integrally with the balance wheel.

38. A balance wheel for use in a horological or other precision instrument comprising:
a balance wheel arm having one or more cross-members formed of a first non-magnetically sensitive material having a first coefficient of thermal expansion;
a plurality of concave segments formed of a second non magnetically sensitive material having a second coefficient of thermal expansion which is positive; and
wherein said second coefficient of thermal expansion is greater than said first coefficient of thermal expansion, such that with an increase in temperature said concave segments extend further radially inward causing a reduction in the moment of inertia of the balance wheel.

39. A balance wheel according to claim 38 wherein there are a plurality of appendages to the concave segments in the form of non-magnetically sensitive timing weights.

40. A balance wheel according to claim 38 or 39 wherein said concave segments form a rim of the balance wheel.

41. A balance wheel according to claim 38 or 39 wherein said balance wheel has a rim attached to said cross members and said concave segments are formed of a different material to the rim and arranged inside the rim.

42. A balance wheel according to any one of claims 38 to 41 wherein the concave segments are attached to the cross members or to a rim of the balance wheel.

43. A balance wheel according to any one of claims 38 to 42 wherein said first coefficient of thermal expansion is negative, whereby a decrease in the cross member length(s) and increase in the concave rim segment lengths with rising temperature causes reduction in the moment of inertia of the balance wheel.

44. A balance wheel according to any one of claims 38 to 43 wherein the rim segments are each arcs of from 45 to 180 degrees.

45. A balance wheel according to claim 39 or any one of claims 40 to 44 when dependent from claim 39 wherein at least two of the appendages are positioned between adjacent concave segments of the rim.

46. A balance wheel according to any one of claims 38 to 45 wherein the first and second coefficients of thermal expansion are linear.

47. A balance wheel according to any one of claims 38 to 46 wherein the balance wheel has two or more appendages

arranged on the cross member(s) or the rim or said concave segments, said appendage(s) comprising a stem and an eccentric head on the stem, the stem being rotably mounted in an aperture of the balance wheel such that it is rotatable about an axis parallel to the axis of rotation of the balance wheel, whereby the moment of inertia of the balance wheel can be fine tuned by turning of the eccentric head.

48. A balance wheel according to claim 47 wherein the adjustment member is a screw.

49. A balance wheel according to claims 47 or 48 wherein the head of the adjustment member tapers towards a top end remote from the stem and is provided with splines for engaging an adjustment tool.

50. A balance wheel assembly comprising a balance wheel according to any one of claims 20 to 49 and a balance staff formed integrally with the balance wheel.

51. A mechanical oscillator system for use in a horological mechanism or other precision instrument, the system comprising a non-magnetic balance spring of flat spiral or helecoidal form and a non-magnetic balance wheel; the balance spring being formed of a ceramic material or a material comprising continuous fibres; the balance wheel being formed of a material having a coefficient of thermal expansion of less that $6\times10^{-6}K^{-1}$; the balance wheel further comprising a plurality of non-magnetic poising or timing appendages for making

adjustments to the moment of inertia of the balance wheel.

52. A mechanical oscillator system according to claim 51 wherein the balance wheel is planar.

53. A mechanical oscillator system according to claim 51 or 52 wherein the appendages are arranged to give equipoise to the balance wheel.

54. A mechanical oscillator system according to any one of claims 51 to 53 wherein one or more of the appendages is an adjustment member comprising a stem and an eccentric head on the stem, the stem being rotably mounted in an aperture of the balance wheel such that it is rotatable about an axis parallel to the axis of rotation of the balance wheel, whereby the moment of inertia of the balance wheel can be fine tuned by turning of the eccentric head.

55. A mechanical oscillator system according to claim 54 wherein the adjustment member is a screw.

56. A mechanical oscillator system according to any one of claims 51 or 56 wherein the head of the adjustment member tapers to an end remote from the stem and is provided with splines for engaging an adjustment.

57. A mechanical oscillator system according to any one of claims 51 to 56 wherein the balance spring is formed of the same material and integrally with the balance wheel.

58. A mechanical oscillator system according to any one of claims 51 to 58 wherein the balance and spring are formed separately and then joined by fusing or gluing together.

59. A balance wheel assembly for use in a mechanical oscillator system for a horological or other precision instrument, comprising an integral balance staff and balance wheel integrally formed from an isotropic non-magnetic material having a thermal coefficient of expansion less than $6\times10^{-6}K^{-1}$.

60. An assembly for use in a mechanical oscillator system for a horological or other precision instrument comprising a balance staff and integrally formed with the balance staff one or more cross members for supporting a balance wheel rim, the cross members and balance staff being formed of a non-magnetic material having a thermal coefficient of expansion less than $6\times10^{-6}K^{-1}$.

60. An assembly according to claim 61 further comprising a balance rim attached to the cross member(s).

61. An assembly according to any one of claims 59 to 61 having a balance wheel according to any one of claims 20 to 50.

62. A mechanical oscillator system according to any one of claims 51 to 58 and having an assembly according to any one of claims 59 to 61.

63. A method of forming an assembly according to any one of claim 60 by attaching the balance rim to the cross member(s) when both are in their green state, by bonding or heat treating.

64. A method of forming a balance wheel assembly for use in a horological or other precision mechanism, comprising attaching a separate ceramic staff and balance wheel together when they are in their green state and using a bonding or heat treatment process to secure them together; the balance wheel and balance staff being non-magnetic and having a coefficient of thermal expansion less than $6\times10^{-6}K^{-1}$.

65. A method of forming a balance wheel according to claim 64 wherein the balance wheel and balance staff are both formed of a ceramic material.